Appendix 3
Revised: July 27, 2001

Outline For Independent Consultant
Inspection Reports 1/ 2/

Pursuant to Part 12, Subpart D of the Commission's regulations, owners of hydroelectric projects subject to the jurisdiction of the Federal Energy Regulatory Commission are required to retain an independent consultant at five-year intervals to inspect the project works and evaluate and identify any actual or potential deficiencies that might endanger public safety.

The scope of the field inspection, contents of the inspection report and the implementation of corrective measures recommended by the independent consultant are covered in Part 12, Subpart D of the Commission's regulations.

The contents of the Independent Consultant's Safety Inspection Report should include, but not be limited to, the following, as appropriate. The consultant should be prepared to submit, if requested, diskettes containing computer programs with documentation and input files for any computer analysis used to reach the conclusions in the report. 3/

I. Summary (Significant Findings)

- A. Field Inspection
- B. Stability Evaluation
- C. Spillway Adequacy
- D. Operation and Maintenance
- E. Monitoring Data

II. Description of Project Features

- A. Dam(s)
- B. Spillways(s) (to include gates and flashboards if present)
- C. Powerhouse(s)
- D. Intake and Outlet Works (i.e. Canals, Tunnels, Penstock, Surgetanks)
- E. Map of Vicinity
- F. Plan and Sectional Drawings
- G. Standard Operational Procedures (i.e. Reservoir Levels, Gate Operations)

III. Summary of Construction History and Operation Obtained From Various Information Sources, Such As:

A. Design Reports
B. Laboratory Reports
C. Construction Reports
(include any design changes during construction)
D. Geology Reports
E. Seismicity Reports
F. Plans and Specification Documents
G. Operation and Maintenance Reports
H. National Dam Safety Inspection Reports
I. Memoranda of Agreement or Memoranda of Understanding (applicable provisions affecting design or operation)

IV. Geologic and Seismic Considerations

A. Regional Geology
B. Local Geology
C. Foundation Condition
D. Faulting
E. Seismicity
F. Sinkhole Potential
G. Foundation Stability
H. Artesian Potential

V. Instrumentation (Refer to Chapter IX of the FERC Engineering Guidelines for instrumentation requirements.)

A. Location and Type (In every report, include Plan and Sectional Drawings with all instrumentation locations.)
B. Time vs. Reading Graphs of Data (For piezometer installations state the tip, ground surface and top of riser pipe elevations and type of installation for each piezometer on each data sheet.)
C. Evaluation

VI. Field Inspection 4a/ The observations made during the field inspection of each main structure should be discussed. Photographs should be included to record the observed structural conditions. Particular attention should be given concerning:

A. Settlement
B. Movement
C. Erosion
D. Seepage
E. Leakage
F. Cracking
G. Deterioration
H. Geologic Conditions
I. Foundation Deterioration
J. Condition of Spillways, Gates 4b/, Penstocks, Flashboards and all Outlets
K. Observation of Operation of Representative Number of Spillway Gates and Standby Power
L. Reservoir Rim Stability
M. Uplift Pressures in Structures, Foundations, and Abutments
N. Functioning of Foundation Drains and Relief Wells
O. Mode of Project Operation - Adequacy of Safety Alert Systems 4c/
P. Other Significant Conditions

VII. Spillway Adequacy

A. Floods of Record 5a/
B. Inflow Design Flood (provide input/output table) 5b/
   1. Determination of Probable Maximum Flood (Assumptions, Analyses, Results)
      a. Probable Maximum Precipitation Distribution 5c/
      b. Precipitation/Runoff Model
      c. Runoff and Flood Routing Procedures
   2. Freeboard Adequacy
   3. Dam Break Analysis (Inadequate Spillway Capacity)
C. Spillway Rating Curve

VIII. Structural Stability – Discuss the following elements for each main structure:

A. Visual Observations
B. Method of Analysis
C. Properties of Materials Based on Site Specific Data
D. Uplift Assumptions (Concrete Structures)
E. Phreatic Surface Assumptions (Embankments)

F. Factors of Safety
G. Stress Analysis & Evaluation
H. Loading Diagrams and Summary of Results
I. Seismic Stability (Earthfill Structures and Soil Foundations)
   1. Liquefaction Potential
   2. Post Earthquake Stability
   3. Potential Seismic Deformation
J. Seismic Stability (Concrete Structures)
K. Summary of Results (presented in table format)

IX. Adequacy of Maintenance and Methods of Operation

A. Procedures
B. Maintenance of Dam
C. Maintenance of Facilities
D. Surveillance
E. Evaluation

X. Emergency Action Plan (EAP)

A. Properly addresses and includes site-specific requirements concerning the detection and corrective actions to prevent dam safety problems or ultimately, dam failure.

B. Discuss if pre-planned actions included in EAP are clearly presented and understood by operating personnel to assure that appropriate actions are taken to attempt to prevent a failure of project facilities.

XI. Conclusions

A. Assessment of Dams and Other Water Retaining Structures
   1. Field Inspection
   2. Stability Analysis (Adequacy of Factors of Safety)
   3. Stress Evaluation
   4. Spillway Adequacy
B. Adequacy of Instrumentation and Monitoring of Instrumentation
C. Adequacy of Maintenance and Surveillance
D. Adequacy of Project Operation
E. Adequacy of Operation of Spillway Gates and Standby Power (Conclusion must demonstrate that gates can be operated

anytime including during emergencies and that standby power and cranes are in operable conditions.)

XII. Recommendations

A. Corrective Measures Required for the Structures
B. Corrective Measures Required for the Maintenance or Surveillance Procedures
C. Corrective Measures Required for the Methods of Operation of the Project Works
D. Schedule to Carry out Each Corrective Measure
E. Any new or Additional Monitoring Instruments, Periodic observations, or Other Methods of Monitoring Project Works or Conditions That May be Required

XIII. Certification

A. Statement of Independence
B. List of Participants
C. Signature of Independent Consultant

XIV. Appendices

A. FERC Letter Approving Consultant
B1. Scope of Work (Obtain from Contract Document Between Independent Consultant and Licensee or Exemptee)
B2. Log of dates and time of inspection
C. Consultant's Resume (Qualifications)
D. Basic Data and Analyses 6/

1/ In the initial report, omission of any item in the outline must be fully justified.

2/ The report prepared after the completion of any dam safety remedial measures constructed after the completion of an approved Part 12 Inspection Report will generally cover operation and maintenance of the facility and a review to determine whether project conditions or assumptions made in previous analyses have changed. The review should include a summary of the dam safety modifications made to the project structures that have occurred since the previous Part 12 Inspection Report. Therefore, plans, elevations, and sections of the principal project works, as modified, must be updated in the current report. A summary of the design assumptions (e.g. loading conditions [including IDF], strength parameters, uplift, spillway rating

curve, etc.) and factors of safety should be included. Any changed conditions should be reported including an explanation as to whether any such conditions affect the performance or stability of the structures. This would be based on a review of any monitoring information and any changes in physical condition noted during the inspection by the independent consultant. If changes in conditions are indicated, stability analyses should be appropriately revised. In conjunction with this, the independent consultant should analyze the adequacy of existing monitoring instruments, periodic observation programs, and other methods of monitoring project works and conditions affecting the safety of the project or project works.

3/ To the extent that conditions, assumptions, information and analyses identified in Section 12.37c (2) (i) and (ii), and in this outline have not changed and were included in approved reports prepared by independent consultants in compliance with Order No. 122 subsequent to March 1, 1981, the information and analyses may be incorporated by specific reference to such previous reports. Items of basic data and analyses must, however, be included in Appendix D for all reports.

4a/ Include a copy of the Engineer's Log showing the date and time that the field inspection began and the date and time that the field inspection was completed. The Engineer's Log should include information on weather conditions during the inspection along with identification of the project features inspected.

4b/ Tainter Gate Inspection - In accordance with lessons learned from the gate failure at Folsom Dam in 1995, the consultant should include the following in the inspection and inspection report:

1. A careful inspection of each gate including all structural members and trunnions, and specifically address the findings of this inspection in the Part 12-D Inspection Report.
2. An evaluation of the forces and moments due to trunnion friction that can be sustained with a temporary over stress allowance of 1.33 on the steel strength. In the absence of a measured value, a friction coefficient of 0.3 shall be assumed with the gate under full hydrostatic pressure. If calculations indicate that any gate can not sustain this load case, recommendations for necessary remedial measures should be included in the Part 12-D Inspection Report.

3. Comments on the appropriateness of lubrication procedures as well as other maintenance activities.

4. Comments on the records of amperage draw and line to line voltage that have been compiled. Specifically, your consultant shall compare the rated horsepower with these recorded values. This will give an indication of the reserve capacity available in the lifting machinery and allow the opening resistance of a gate to be compared with respect to time and other gates.

4c/ Unattended Projects Sites - If a project site is unattended, the consultant must include an assessment of the adequacy of project instrumentation, remote monitoring capability of instrumentation, access to the site during flood conditions for operating gates or equipment, and the need for special instructions in the Emergency Action Plan for manning the site at particular times, e.g. period following a significant earthquake, or flood conditions above a predetermined flood event.

5a/ If a PMF study has been previously developed and the IDF is equal to the PMF, the consultant should review the streamflow and precipitation data in the project basin that have been collected since the completion of the PMF study for any significant flood events that may have a bearing on the determination of the PMF. All of these significant flood events should be documented in the current report. The consultant should discuss the effect these flood events may have on the assumptions used to develop the PMF. If necessary, the consultant should recalibrate and verify the PMF model in accordance with our engineering guidelines using these significant flood events.

5b/ Changes in downstream development should be stated with a determination as to whether any new development impacts the IDF or the hazard rating potential. To this extent, the consultant should review the previous dam failure studies to determine the areas downstream where development could impact the IDF, and provide documentation that there is no new development in these areas.

5c/ If a licensee elects to have a site specific PMP study performed for a project rather than using the PMP values determined from an accepted HMR for the area, a Board of Consultants (BOC) will have to be proposed by the licensee for guiding/overseeing the study, and the BOC approved by FERC.

6/ Basic Data and Analyses - Appendix D of every report must contain the basic spillway adequacy data and the basic data and critical analyses for each of the project structures. Once a report with an Appendix D has been accepted, Appendix D of subsequent reports should be a clear legible reproduction of the previously accepted Appendix D, except for the portions where changes have occurred. Changed conditions must be updated. Revisions will be made accordingly, when it is determined by the licensee/exemptee, its independent consultant, or FERC staff that additional information should be provided. The intent of the Appendix D requirement is to consolidate a summary of all studies into one location for documentation and reference. Appendix D should not contain a copy of detailed analyses and discussions, but rather, it should contain legible summary paragraphs, tables or graphs, as appropriate, of the following information that can be excerpted from previous reports (illegible copies are not acceptable):

1. Spillway Adequacy.

    a. Summary paragraphs of methodology used to determine the PMF.
    b. Table of PMP values and their source.
    c. Spillway capacity and corresponding headwater elevation.
    d. Spillway rating curve showing breakdown for each spillway structure.
    e. Inflow and outflow hydrographs for the PMF and IDF.

2. Structural Stability

    a. A drawing of the critical cross section of each water retaining structure and its foundation for each required loading condition, showing:

        i. Material properties.
        ii. Dimensions and elevations.
        iii. Headwater and tailwater elevations.
        iv. Loading condition and vector loads.
        v. Uplift distribution or phreatic surface.
        vi. Location of drains and piezometers, if any.
        vii. Critical factors of safety.

    b. Summary paragraphs of methodologies used for analyzing each loading condition, and for determining shear strength parameters for each loading condition and material properties, including how test results were interpreted to select the strength parameters.

    c. Summary table showing the critical factors of safety for each loading condition of all the structures.

    d. A typical detail at the toe of each water retaining structure (including its foundation and instrumentation) for each case where artesian pressure is present in the foundation, or may be present at floods up to the IDF. The safety factor of the foundation at the toe should be determined based on the worst case loading condition.

    e. Significant summary paragraphs from the site-specific seismicity study, if applicable.

    f. Significant summary paragraphs from any post-construction work affecting dam safety, if applicable.